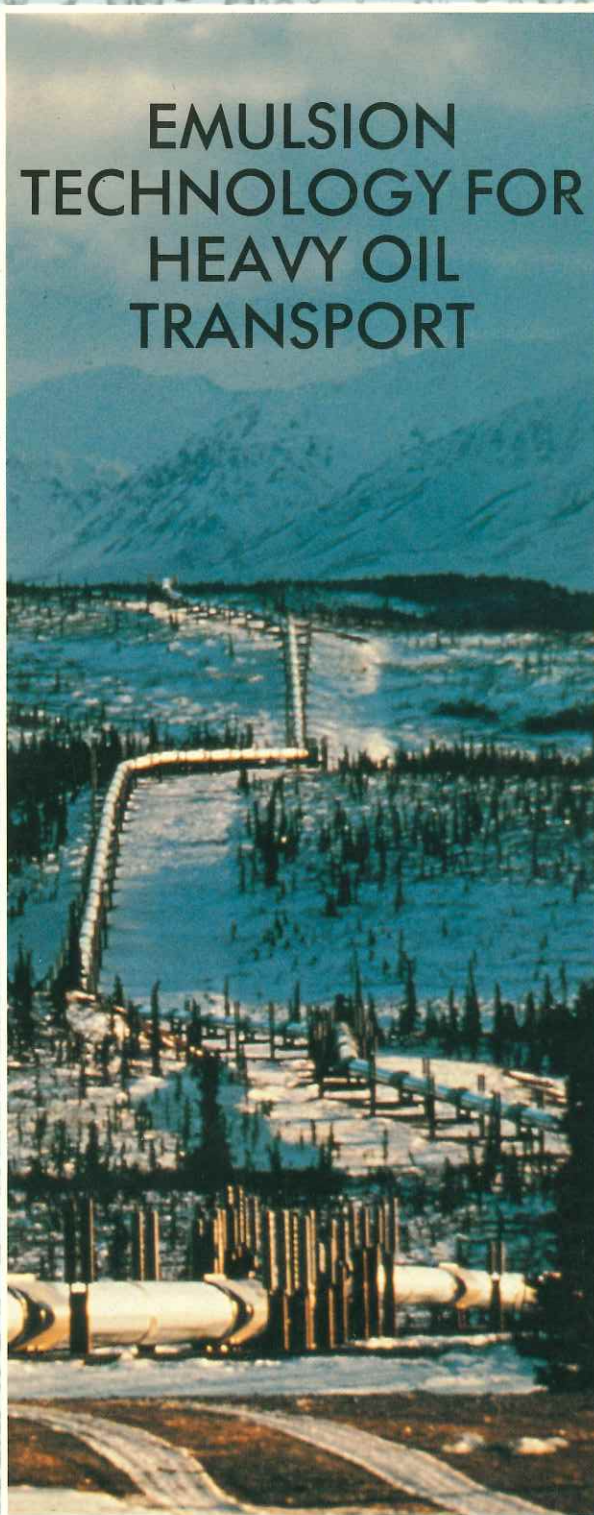


BP

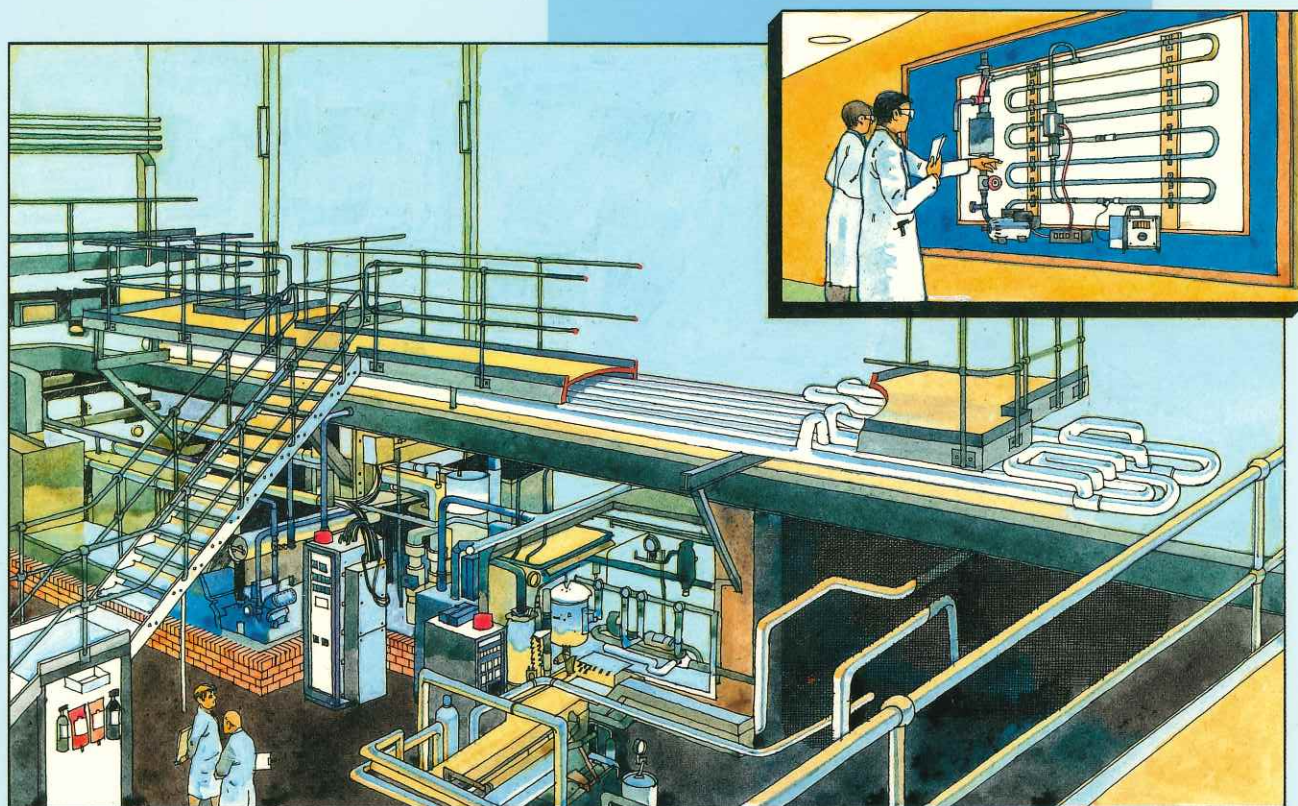
TRANSOIL

EMULSION TECHNOLOGY FOR HEAVY OIL TRANSPORT

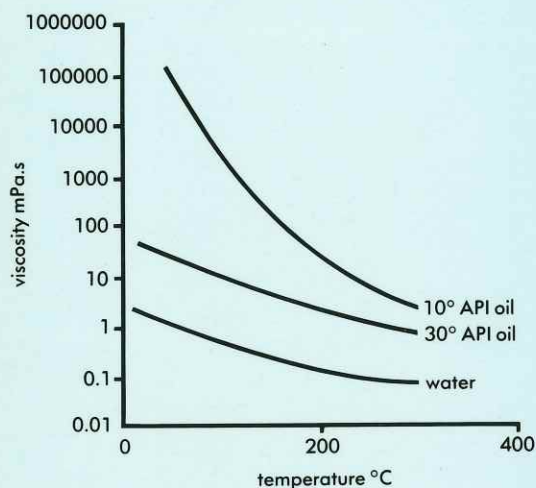


TRANSOIL technology has been extensively evaluated in both laboratory and field trials for use in a wide range of environmental conditions.

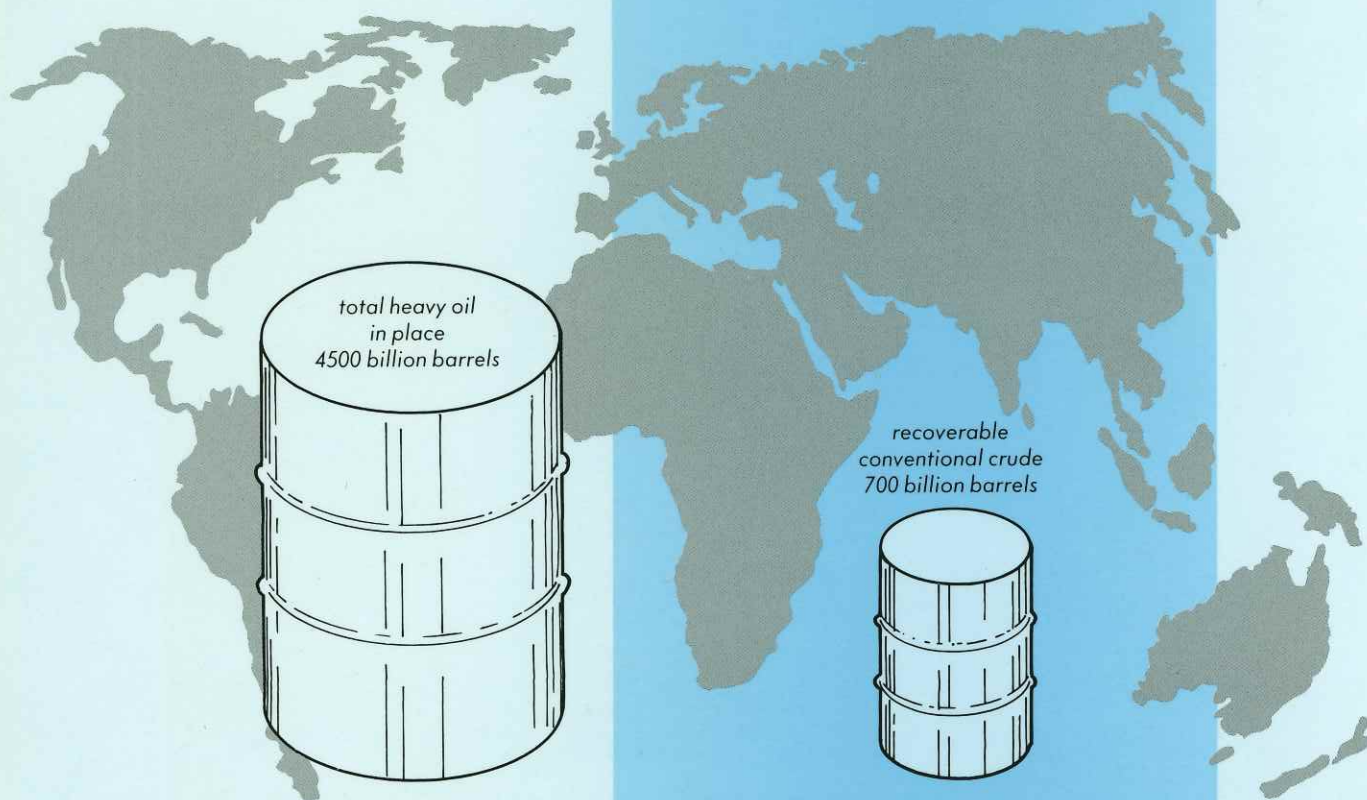
Much of the development work on TRANSOIL technology has been carried out by researchers at the BP Research Centre on these temperature-controlled flowloops. The larger 100m loop has been used to demonstrate successfully the dynamic stability and transportation characteristics of TRANSOIL emulsions under typical Canadian pipeline conditions.



THE PROBLEM



Heavy crude oils and bitumens are difficult to produce, transport and process economically because they are exceptionally viscous - anything up to a million times more viscous than water. A solution to the problems presented by this high viscosity would provide the key to unlock massive world hydrocarbon resources, at present largely untapped.



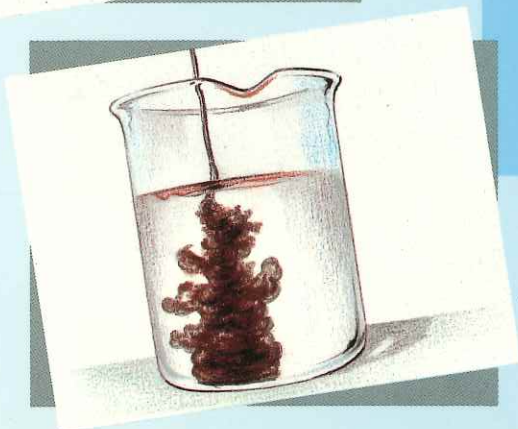
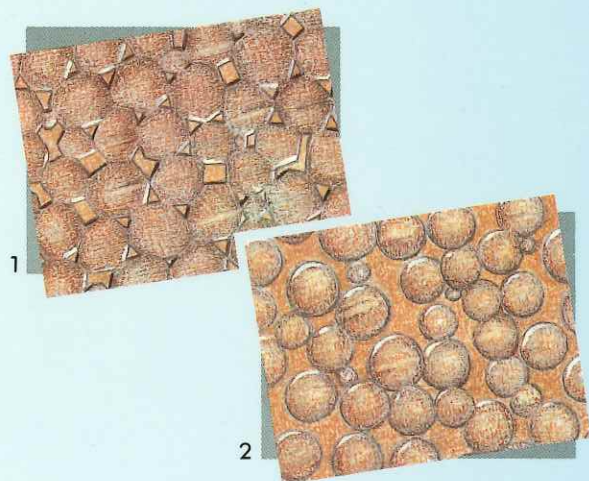
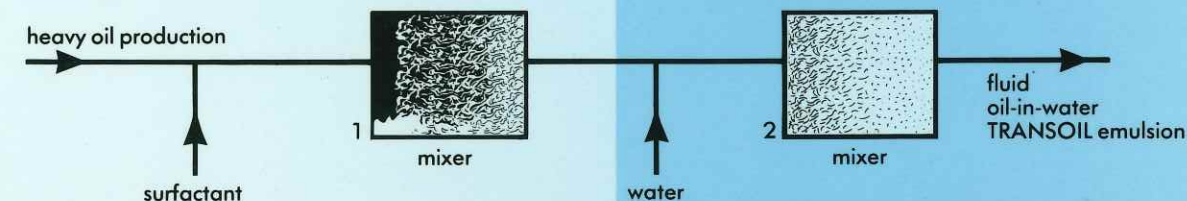
The total quantity of discovered heavy oil-in-place is estimated to be at least 4500 billion barrels. By comparison reserves of conventional oil are presently estimated to be about 700 billion barrels (recoverable).

Front Cover: A photomicrograph of the heavy oil-in-water emulsion produced by **TRANSOIL** technology. Note the homogeneity of the emulsion which has a mean droplet size of 10 μm .

Inset is the Trans Alaskan pipeline used to transport oil from the North Slope to Valdez. There are vast reserves of heavy oil on the North Slope which could be transported using **TRANSOIL** technology despite the extremes of winter climate.

THE SOLUTION

1. Emulsion formed in the first stage mixing process.
2. Diluted emulsion



TRANSOIL technology is a story of successful collaboration between The British Petroleum Company p.l.c. (BP) and Petroleos de Venezuela.

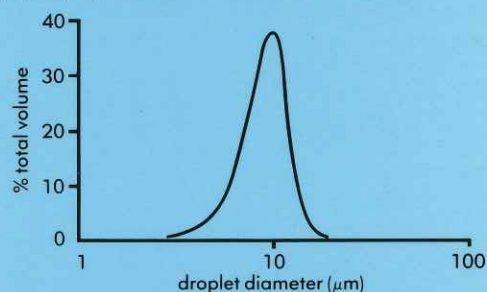
TRANSOIL technology was discovered by scientists working at the BP Research Centre in the United Kingdom as part of a fully collaborative R&D programme with INTEVEP, the research arm of Petroleos de Venezuela.

TRANSOIL technology works by producing fluid oil-in-water emulsions in a controlled two-stage mixing process.

In the first stage, heavy oil and water containing low concentrations of a commercially available surfactant are mixed together. This process forms polyhedral shaped oil droplets separated by thin films of aqueous surfactant solution.

In the second stage, diluent water is added to reduce the viscosity of the emulsion - typically to the 50-100 mPa.s range.

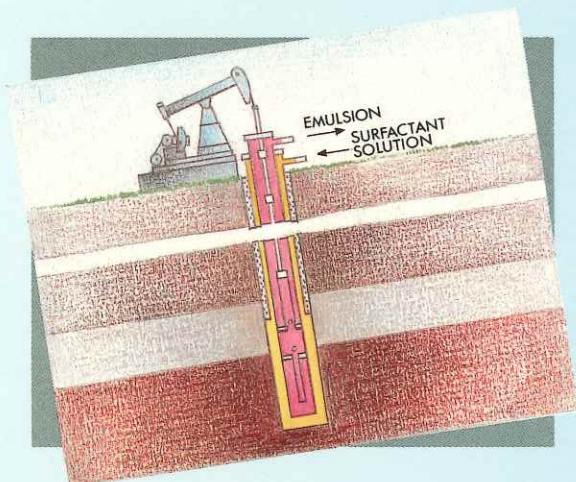
The emulsions contain oil droplets with a narrow, well-defined and controllable size range. This has advantages for both transportation and demulsification. There are no extremely large droplets (eg. 50 μm) which could settle out in a pipeline and there are no very small droplets (eg. 1 μm) which would be difficult to resolve.



Droplet size distribution curve for Wolf Lake oil-in-water emulsion.

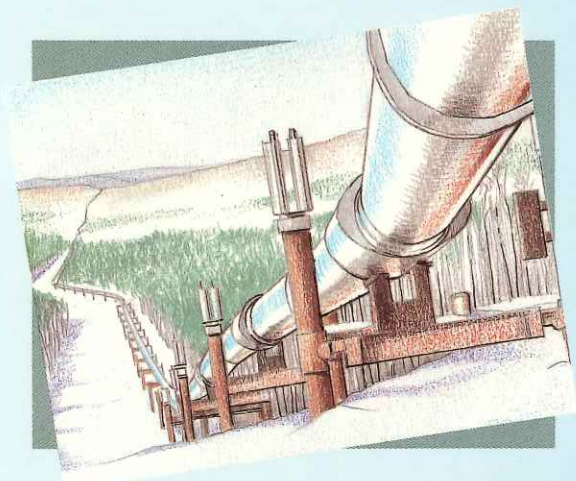
Emulsions prepared in this way use the surfactant more efficiently than any current competitive technology. The surfactant is placed where you want it - at the oil/water interface. Exotic cocktails of speciality surfactants and polymers are not required to stabilise the emulsion and so the process is economically more attractive than competing technologies.

THE APPLICATIONS



Production

TRANSOIL technology can be adapted to produce oil-in-water emulsions downhole. This reduces the pressure drop in production tubing, saves energy and can increase heavy oil production rates. Because downhole emulsification inverts the naturally produced water-in-oil emulsion to its much less viscous oil-in-water counterpart, surface processing is reduced by eliminating the need to dehydrate and desalt the heavy crude oil.



Transportation

TRANSOIL technology can also be used for surface emulsification. Oil-in-water emulsions can be prepared from wet crude, again reducing surface processing.

TRANSOIL technology allows operators to meet pipeline viscosity specifications without the need to add expensive diluent. The emulsions are stable during tanker and pipeline transportation yet can be easily broken in refinery desalters.



Combustion

The emulsions prepared by TRANSOIL technology can be used directly as fuels for boilers and heaters, whether or not a transportation stage is involved. The advantages of this preatomised fuel are its ease of handling and, when burned, reduced NO_x and particulate emissions.



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